

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently Amended) A pupil detection device comprising:

a partial frame memory for inputting image data, the partial frame memory including a plurality of line memories of a first-in first-out (FIFO) type being connected in series;

a plurality of drawing lines for extracting imagean image data extraction unit for determining from a plurality of circles pixels on an eye image asrespective circumferences of a plurality of concentric integrating circles respectively, and extracting anin the image data of the eye image positioned on the circumferences of the integrating circlesretained by the partial frame memory;

a plurality of adders, each of the plurality of adders corresponding to each of contour integrating unit integrating the image data extracted by the image data extraction unit along the respective circumferences of the plurality of concentric integrating circles and for adding the image data extracted by the plurality of drawing lines with respect to the respective circumferences of the plurality of concentric integrating circles;

a pupil radius detection unit for (i) calculating a difference value between added values of two of the plurality of concentric integrating circles, the two circles having the closest radius out of the plurality of concentric integrating circles, and (ii) comparing the difference value to a predetermined threshold value calculated by a relation of an average luminance of a pupil and an average luminance of an irisdetecting that an integrated value obtained by the contour integrating unit has changed stepwise with respect to the radius of the integrating circle;

wherein the pupil radius detection unit compares the difference value and the predetermined threshold value every time the partial frame memory inputs the image data by one pixel and determines that the image data retained by the partial frame memory contains an image of the pupil when the difference value is larger than the predetermined threshold value.

~~_____ a pupil position detection unit for detecting that the center coordinates of the integrating circle as pupil position coordinates when the pupil radius detection unit detects the stepwise change,~~

~~_____ wherein the plurality of circles are set concentrically, and the image data extraction unit extracts the plurality of image data simultaneously.~~

2. (Cancelled)

3. (Currently Amended) The pupil detection device of ~~Claim 2~~Claim 1, wherein the predetermined threshold is set to a range between 1/4 to 1/1 times the difference ~~between the~~ between an integrated value of an average luminance of the pupil when the integrating circle is located on an iris and the ~~and an integrated value of an average luminance of the iris when the integrating circle is located on a pupil.~~

4. (Cancelled)

5. (Currently Amended) The pupil detection device of ~~Claim 4~~Claim 1, further comprising a pointer unit for indicating center coordinates of the plurality of concentric integrating circle~~circles~~,

the pointer unit comprising a counter for counting a clock synchronized with a period for acquiring the image data on the partial frame memory.

6. - 8. (Cancelled)

9. (Currently Amended) An iris authentication apparatus comprising: ~~the pupil detection device of Claim 1~~

a partial frame memory for inputting image data, the partial frame memory including a plurality of line memories of a first-in first-out (FIFO) type being connected in series;

_____ a plurality of drawing lines for extracting image data from a plurality of pixels on respective circumferences of a plurality of concentric integrating circles in the image data retained by the partial frame memory;

a plurality of adders, each of the plurality of adders corresponding to each of the plurality of concentric integrating circles and for adding the image data extracted by the plurality of drawing lines with respect to the respective circumferences of the plurality of concentric integrating circles;

a pupil radius detection unit for (i) calculating a difference value between added values of two of the plurality of concentric integrating circles, the two circles having the closest radius out of the plurality of concentric integrating circles, and (ii) comparing the difference value to a predetermined threshold value calculated by a relation of an average luminance of a pupil and an average luminance of an iris,

wherein the pupil radius detection unit compares the difference value and the predetermined threshold value every time the partial frame memory inputs the image data by one pixel and determines that the image data retained by the partial frame memory contains an image of the pupil when the difference value is larger than the predetermined threshold value.

10. (Cancelled)

11. (Currently Amended) An iris authentication apparatus according to claim 9, wherein the predetermined threshold is set to a range between 1/4 to 1/1 times the difference between an integrated value of an average luminance of the pupil and an integrated value of an average luminance of the iris~~comprising the pupil detection device of Claim 3.~~

12. (Cancelled)

13. (Currently Amended) An iris authentication apparatus according to claim 9, further comprising a pointer unit for indicating center coordinates of the plurality of concentric integrating circles,

the pointer unit comprising a counter for counting a clock synchronized with a period for acquiring the image data on the partial frame memory~~the pupil detection device of Claim 5.~~

14. - 16. (Cancelled)

17. (New) A pupil detection device comprising:

a partial frame memory for inputting image data, the partial frame memory including a plurality of line memories of a first-in first-out (FIFO) type being connected in series;

a plurality of drawing lines for extracting image data from a plurality of pixels on respective circumferences of a plurality of concentric integrating circles in the image data, in which an iris and a pupil are to be photographed, retained by the partial frame memory;

a plurality of adders, each of the plurality of adders corresponding to each of the plurality of concentric integrating circles and for adding the image data extracted by the plurality of drawing lines with respect to the respective circumferences of the plurality of concentric integrating circles;

a pupil radius detection unit for (i) calculating a difference value between added values of two of the plurality of concentric integrating circles, the two circles having the closest radius out of the plurality of concentric integrating circles, and (ii) comparing the difference value to a threshold value which is set in a range between $1/4$ to $1/1$ times the difference between an integrated value of an average luminance of the pupil and an integrated value of an average luminance of the iris,

wherein the pupil radius detection unit compares the difference value and the threshold value every time the partial frame memory inputs the image data by one pixel and determines that the image data retained by the partial frame memory contains an image of the pupil when the difference value is larger than the threshold value.

18. (New) An iris authentication apparatus comprising:

a partial frame memory for inputting image data, the partial frame memory including a plurality of line memories of a first-in first-out (FIFO) type being connected in series;

a plurality of drawing lines for extracting image data from a plurality of pixels on respective circumferences of a plurality of concentric integrating circles in the image data, in which an iris and a pupil are to be photographed, retained by the partial frame memory;

a plurality of adders, each of the plurality of adders corresponding to each of the plurality of concentric integrating circles and for adding the image data extracted by the

plurality of drawing lines with respect to the respective circumferences of the plurality of concentric integrating circles;

a pupil radius detection unit for (i) calculating a difference value between added values of two of the plurality of concentric integrating circles, the two circles having the closest radius out of the plurality of concentric integrating circles, and (ii) comparing the difference value to a threshold value which is set in a range between $1/4$ to $1/1$ times the difference between an integrated value of an average luminance of the pupil and an integrated value of an average luminance of the iris,

wherein the pupil radius detection unit compares the difference value and the threshold value every time the partial frame memory inputs the image data by one pixel and determines that the image data retained by the partial frame memory contains an image of the pupil when the difference value is larger than the threshold value.